Age and Gender Differences in the Value of Productive Activities

Four Different Approaches

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The definition of personal productivity based on paid work is expanded to include many forms of unpaid work. The productivity of these forms of unpaid work is estimated empirically, using several economic approaches (an opportunity cost approach, a market price approach, and a value-added approach) and one noneconomic approach. Additionally, two methods of dealing with selection bias when estimating opportunity costs for nonemployed persons are compared. These different approaches all document the extent to which many of the activities (such as housework, formal volunteer work, or informal help to relatives and friends) that are often performed without pay by older Americans or women are actually productive because they produce goods and services to which a market value can be imputed. Using this expanded definition to describe the productive contribution of men and women at different ages provides a much needed correction to existing social statistics: Women contribute in major ways to U.S. productivity, as do older adults, although to a lesser degree. These findings challenge the stereotypic view of older Americans as unproductive and mere burdens on society. Data were from a 1986 cross-sectional survey of 3,617 adults representative of those 25 years old and older living in the coterminous United States.

Are older Americans productive members of this society or are they simply users of national resources and thus a burden to society? This

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question is of great interest to many political institutions and private citizens who are concerned with the impact of an aging society. Most attempts to answer the question would refer to labor force participation rates among older Americans, because productivity in this society is strongly equated with goods and services produced in the market. Such a definition underlies, for example, the concept of the Gross National Product and some formulations of the infamous dependency ratio. However, such a definition provides at best a partial answer.

Limitations of defining productivity in terms of labor force participation have been well recognized in previous work on gender roles and women's work: Because of societal proscriptions about proper roles, even today women typically carry primary responsibility for raising a couple's children, running the household, and caring for elderly parents. Consequently, their labor force participation in terms of full-time effort, number of years of work throughout their lifetime, and career progression are often reduced; yet their productive contributions in terms of housework and caring for others are typically substantial. Recent legal and policy discussions and decisions acknowledge women's unpaid contributions in divorce settlements and in Social Security and pension benefits.

The limitations inherent in a narrow definition of productivity are less well recognized in gerontological literature, which is still primarily focused on retirement as a transition from productive to nonproductive life. Consequently, discussions in the gerontology literature tend to focus on society's loss of the productivity of the elderly and on the aging individual's loss of the focus of identity and a source of well-being. Even while taking account of alternatives to paid work after retirement, gerontologists continue to focus on such nonproductive social and physical behaviors as leisure activities or social contacts with relatives and friends. A broader definition of productive involvement in older age is needed in order to inform and broaden the discussion concerning productivity in old age.

The difficulties in meeting such a challenge, however, are enormous. Some efforts have been made in the econometric literature to

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measure the time spent in a limited set of presumably productive but unpaid activities such as housework and child care and, to a lesser degree, maintenance of home, yard, and automobile. Research has typically shown that men and women spend considerable efforts in such unpaid activities, and that women expend more effort than men (Juster and Stafford 1985; Meissner, Humphreys, Meis, and Scheu 1975; Morgan 1981, 1984). In the gerontological literature, formal volunteer work, informal help to others, and self-care have drawn recent attention, and findings suggest that older adults engage in a variety of these activities (Chambré 1987; Harris and Associates 1975). Herzog et al. assessed the performance of a fairly comprehensive set of presumably productive activities, including housework, child care, maintenance of home and possessions, volunteer work, informal assistance to relatives and friends, and care provided to impaired others (Herzog, Kahn, Morgan, Jackson, and Antonucci 1989). Among men as well as women, an age-related decrease in total productive hours was found, but this decrease was primarily a function of their decreased hours of paid work and child care. In other words, there were no major age differences in volunteer work, housework, and home maintenance. Of course, such age differences (or the lack thereof) from cross-sectional data confound aging and cohort effects, and no claims for one or the other effect were made. At all ages, productive time for women was found to be at least the same or greater than for men, but compared to men, women spent more of their productive time in unpaid activities.

Although a convincing argument can be made that these and similar activities are indeed productive, and that some of them are more productive than others, their productivity has rarely been empirically estimated. In the labor market, such differences in productivity are associated with wage differentials: Activities that produce more and/or more highly valued goods and services tend to be rewarded with higher wages than those activities producing less and/or less valued goods and services. Persons who produce a certain product faster or at higher quality are paid higher wages than those producing the same product more slowly or at lesser quality. The total productive output of the paid work of a particular person may then be estimated by multiplying the number of hours he or she works by his or her wage rate.

Wage rates are by definition not available to measure the productivity of unpaid work. However, several methods have been proposed to overcome this problem and to arrive at an hourly wage equivalent that can be multiplied by the number of hours spent on unpaid activities to yield a dollar figure for the entire productive output of unpaid activities. One, the *opportunity cost* method, values the hours of any form of unpaid work (and even of leisure) according to the wage that the individual (given education, experience, and labor market conditions) could have earned by working for pay for an equal number of hours. The assumption is that rational people perform each activity until its added value starts to fall below alternatives. For the nonworking population (who do not have a wage rate), the wage is estimated by establishing the effect of such factors as education on hourly earnings in the working population, then using these predictors to estimate the likely wage rate, sometimes with an adjustment for *selection bias* (i.e., the basic persistent differences between those who are working and those who are not). The second method for estimating the monetary value of unpaid work assigns to the unpaid work an hourly dollar amount equal to that required to hire a person to perform an equivalent mix of tasks with equal expertise. This method has been used mainly for estimating the value of housework, and Peskin (1983) refers to it as the *housekeeper cost* technique. Because it is used here for other than housekeeping activities, it is labeled *market price* technique. A third method developed by Morgan and his colleagues (Morgan 1981) asks survey respondents to estimate directly how much they saved by the various categories of unpaid activity in which they engage. These authors refer to it as the *value-added* approach. Morgan obtains such estimates for each unpaid activity and the number of hours spent in the activity. He then works backward to an implied wage rate.

A major criticism of all these methods is that they rely on the current labor market and the monetary system for assessing productive value. Reliance on the labor market implies two specific limitations. First, one might argue that this represents only one, albeit powerful, value system of our society and that less tangible value systems might also be operating. For example, wages for child care are relatively low,

partly because child care is mostly performed by women, yet almost everyone would probably agree that the rearing of the next generation is a very valuable social task. An assessment of the productive value of activities, therefore, should go beyond wage rates derived from the current labor market to explore broader societal benefits. Here a survey question has been developed to measure the degree to which somebody benefits from an activity, without specifying the benefit as material or nonmaterial. A Likert-type rating scale is used to estimate the amount of benefit. Like the value-added approach, the *benefit* approach uses respondent-supplied information for valuing the activity, whereas the opportunity cost and the market price methods rely on information that the investigator generated.

Second, wages paid in the labor market are not a pure reflection of productivity but are also affected by social structural characteristics and by discriminatory practices that bias the wages of the elderly, women, and minorities. There is no attempt to explain such biases in this article; it is merely acknowledged that they represent limitations to the usefulness of methods relying on labor market information for estimating productive value of nonmarket work. Nevertheless, however imperfect the valuation methods that are used, they begin to gauge the magnitude of the productive contribution of older adults.

Third, wage rates measure marginal productivity, excluding all "producer surplus" arising from the fact that intramarginal hours are more productive. Economists prefer marginal productivity because if all factors (land, labor, capital) are paid at their marginal productivity, the total output value is accounted for (used up) in a kind of "fair division."

To summarize, social reporting efforts aimed at monitoring productivity and how it might change as a function of the age of the person are biased by the way productivity is operationalized in most available social statistics. This article presents an alternative approach to correct for this bias (a) by expanding the definition of productivity to include additional unpaid activities and by empirically estimating individual productivity using economic and noneconomic approaches, and (b) by applying the new measures to a description of age patterns in productivity.

Method

DATA SOURCE

Data are from a survey entitled *Americans' Changing Lives* (ACL; Herzog et al. 1989), which used a multistage stratified area probability sample of persons 25 years of age or older and living in the coterminous United States. Blacks and persons over 60 were sampled at twice the rate of Whites under 60, in order to facilitate comparisons by age and race. A total of 3,617 respondents were interviewed in their homes by interviewers of the Survey Research Center, reflecting a response rate of 67%. Nonresponse did not vary substantially by age, race, or other known respondent characteristics. The data are weighted in all analyses to adjust for variations in probabilities of selection and in response rates across sample areas. The data are thus representative of the continental United States. The interviews were conducted between May and October of 1986 and lasted, on average, about 85 minutes each.

TYPES OF ACTIVITIES

As defined here, the concept of productive activity is broad, including activities that generate valued goods or services in ways that allow a market value to be plausibly imputed. Productive activities thus include paid work in both the regular and irregular economy and work inside and outside the household. They do not include activities undertaken solely for one's own enjoyment, although they may include activities that are enjoyed along with the benefit that they produce. Indeed, there is survey evidence that people engaged in paid work get substantive enjoyment from that work as well (Juster 1990; Juster and Stafford 1985).

Operationally, the questions on productive activities cover three main domains:

1. *Paid work* in both the regular and irregular economy, performed for wages, salary, commissions, or profit. Work in the irregular economy includes jobs that people do for each other and for which they pay each other, but that are not part of a regular job. In the irregular

economy, people are not likely to earn fringe benefits, have taxes deducted, or have much job security.

2. *Unpaid work* at home, that is, housework; care provided to children living in one's household; home maintenance and improvement activities, and other do-it-yourself activities like growing food.
3. *Help provided to others*, specifically, help with general chores and errands; help with care to someone who has chronic problems; help to someone with acute problems; and formal volunteer work in churches, hospitals, and other organizations.

QUANTITY OF ACTIVITIES

The quantity of productive activities was measured by asking the respondents how many hours they had spent on each activity category. In order to index the class of activities properly, questions were asked separately about the major activities in each particular category; persons reporting any activities were then asked the questions about hours spent. For paid work and unpaid housework, the actual number of hours spent per average week was elicited. For all other activities except child care, respondents had a choice among categories that defined ranges of hours spent over a 12-month period. For child care, respondents were asked about an average week but were provided hour-range categories. The 12-month recall period was chosen over a shorter recall period, except for the most regular activities, in order to capture rare or seasonal activities that would often be missed in a recall period of a week or a day. This is particularly critical for a study whose major objective is the prediction of individual-level data rather than aggregate rates. The measures seem reasonably valid when compared with time budget estimates, as described elsewhere (Herzog et al. 1989). Exact wording for all questions is available from the first author.

For data analysis midpoints were assigned to response categories indicating an hour range, and weekly estimates were multiplied by 52 to obtain annual equivalents.

PRODUCTIVE VALUE OF ACTIVITIES

The approaches described in the introduction were used to establish the productive value of some of the measured activities in the following way.

Hourly wages. In the ACL study, employed respondents were asked "How much do you earn now from this job?" The pay period for which to report—by hour, day, week, or month—was chosen by the respondent, because when the respondent can answer in the most familiar terms, accuracy is greater than when recalculation is required. Hourly wages were then figured by dividing earnings for units larger than one hour by the number of hours per unit that respondents reported working. The ACL wage data were compared with wage data from the 1985 U.S. Census for comparable age and education subgroups. The subgroup figures matched reasonably well, despite the sometimes rather small cell size for the ACL sample.

Estimated wages. The general approach to estimate an hourly wage for those not currently employed was as follows. A prediction equation for hourly wage among the working population was developed, using as predictors age, gender, occupation, education, marital status, family income other than respondent income, number of persons in household, and race. The categorical regression equation accounted for 30% of the variance in hourly wages. The important predictors were education, gender, occupation, and age. This prediction equation was used to estimate the wage rates for the nonworking population.

Before this approach could be applied, it was necessary to correct a likely selection bias by which those who were more productive in unpaid work were more likely to choose the unpaid activity than paid work, whereas those who were more productive in paid work were more likely to choose paid employment over unpaid activity. Opportunity cost values of unpaid work based on wages of those who work for pay, therefore, may exaggerate the opportunity cost to others who do not. For example, a woman who continued her career uninterrupted throughout her adult life may well command higher wages than a woman of equal age and educational background who stayed home for a decade to raise a family. In order to deal with the selection bias, two approaches were explored to estimate the opportunity costs. The first approach, used typically by econometricians, predicts the likelihood of working for pay by using ordinary categorical regression and then uses the likelihood of working as an additional additive predictor. Because the probabilities of working are not near 0 or 1, the results will be very similar to those from more complicated procedures such

as the one proposed by Heckman (1979), which takes the log odds of working from a probit analysis, converts it into an inverse Mills ratio, and introduces that into the earnings equation. Because the conversion is intended to deal with distributional problems, the use of categorical predictors representing classes of the probability should be adequate and similar. Predictors of the probability of working were respondent age, race, marital status, education, gender of respondent by age of his or her youngest child, family income other than respondent's earnings, and number of persons in the household. The results of predicting the likelihood of working from a categorical regression analysis are shown in Table 1.

The procedure then brackets the predicted probabilities of working into six categories and introduces this variable along with the other predictors (which are not entirely identical with those for the probability of working equation) into the categorical regression equation predicting earnings for the currently working population (Table 2, columns 1 and 2). The important predictors were education, gender, occupation, and age. Using categories for the probability of working avoids the need to worry about the shape of the selection effect (or the error distributions) and provides the gross and net effects of the estimated probability of working on the estimated earnings. Comparing the gross unadjusted effect of the probability of working on the average wage with the effect after adjustment for the other predictors indicates that other variables in the analysis already account for the entire possible selection bias.

The other approach, used more typically by sampling statisticians, is to introduce as a weight the inverse of the probability of inclusion in the wage estimating equation. This approach is relatively free of distributional assumptions and also of assumptions about the way the selection bias affects things (it does not assume that it has a simple additive effect). This approach is preferred and used for estimating hourly earnings among the nonworking population, but some evidence is provided here that the two approaches give very similar results (Table 2, columns 3 and 4). Again, respondent education, gender, occupation, and age are important factors in predicting hourly wages.

Although there is no occupation for those not working, the introduction of occupation into the earnings equation means that in imput-

TABLE 1
Categorical Regression Analysis of the Probability of Working

Predictors	*Unadjusted Probability*	*Adjusted Probability*
Age		
25-34	.80	.81
35-44	.84	.83
45-54	.85	.81
55-64	.53	.54
65-74	.22	.25
75+	.04	.08
	Eta^2.32	$Beta^2$.28
Gender of respondent and age of youngest child		
Women with youngest child 1-2	.50	.33
Women with youngest child 3-5	.63	.48
Women with youngest child 6-11	.74	.58
Women with youngest child 12-16	.82	.65
Women without children	.52	.60
Men	.77	.75
	Eta^2.07	$Beta^2$.05
Education		
0-8 Years completed	.33	.54
9-11 Years completed	.46	.54
12 Years completed	.69	.69
13-15 Years completed	.71	.66
16 or more	.86	.75
	Eta^2.12	$Beta^2$.02
Other family income		
None	.63	.65
Less than $10,000	.51	.57
$10,000-29,999	.71	.68
$30,000 or more	.69	.64
	Eta^2.03	$Beta^2$.01
Number in household		
One	.52	.71
Two	.54	.64
Three	.78	.70
Four	.77	.63
Five or more	.71	.61
	Eta^2.06	$Beta^2$.01
Race		
Black	.65	.66
Non-Black	.66	.65
	Eta^2.00	$Beta^2$.00

TABLE 1 Continued

Predictors	*Unadjusted Probability*	*Adjusted Probability*
Marital status		
Married	.68	.66
Not married	.60	.65
	Eta^2.01	$Beta^2$.00
Adjusted R^2	.41	

NOTE: Eta^2 indicates the gross amount of variance accounted for by the predictor; $Beta^2$ indicates the net amount of variance, controlling for the effects of the other predictors in the equation.

ing a wage for nonworkers, adjustments are made only for the other characteristics. Because the model is additive, this produces no bias, but it assumes that the effects of age and education, for example, are free from the effects of the occupational distribution of those in different age or education groups. The imputation of nonmarket work values is probably more accurate for those with some market work than it is for those who do no market work. It remains possible that those who do more housework and child care are actually better at it, so that the value of their unpaid work is still underestimated.

Market price. The average hourly wage reported by the ACL respondents who engage in domestic services was $3.43, and the hourly wage of those engaging in crafts was $10.99. These two figures (without adjustments for personal characteristics of occupants) are used respectively as estimated cost for child care and housework and for home maintenance. Of course, a domestic employee may perform only basic tasks without the planning and management required of a mother and housewife, thus not performing quite the same mix of duties.

Value-added approach. After having reported the total number of annual hours that they spent in volunteer work and in home maintenance, respondents answered the two respective questions "If the organization had paid someone for the volunteer work you did, about how much do you think it would have cost them? Would you say less than $500, $500 to $1,000, $1,001 to $3,000, or more than $3,000?" and "About how much do you think you saved altogether by doing this kind of (house, yard, automotive) work last year? Would you say

TABLE 2
Two Approaches to Selection Bias:
Categorical Regressions of Hourly Earnings

	Econometric Procedure		*Sampling Procedure*	
Predictors	*Unadjusted Wage (Dollars/hour)*	*Adjusted Wage (Dollars/hour)*	*Unadjusted*[a] *Wage (Dollars/hour)*	*Adjusted Wage (Dollars/hour)*
Education				
0-8 Years completed	6.86	6.63	5.67	6.11
9-11 Years completed	7.52	7.87	6.86	7.13
12 Years completed (HS)	9.14	9.73	8.89	9.29
13-15 Years completed	11.04	11.19	10.66	10.77
16 or more years completed	13.24	12.26	13.00	11.84
	Eta^2.12	$Beta^2$.08	Eta^2.15	$Beta^2$.10
Gender marital status				
Single men	11.38	11.05	10.65	10.37
Single women	8.53	8.50	7.29	7.88
Married men	12.17	11.97	11.63	11.33
Married women	8.33	8.79	8.11	8.19
	Eta^2.09	$Beta^2$.07	Eta^2.10	$Beta^2$.07
Occupation				
Professional	12.49	11.43	11.90	10.56
Managerial	13.35	12.24	12.49	11.46
Sales	11.84	11.25	10.93	10.28
Clerical	8.59	9.51	8.46	8.91
Skilled workers	10.99	10.94	10.79	10.37
Operatives	8.67	9.51	8.18	9.18
Laborers	8.86	9.67	8.46	9.12
Farmers, farm laborers	8.91	8.66	7.45	7.30
Service workers	6.21	7.62	5.37	7.06
Domestic service	3.43	6.56	3.35	6.48
	Eta^2.17	$Beta^2$.06	Eta^2.18	$Beta^2$.06
Age				
25-34	9.67	9.33	9.23	8.52
35-44	10.78	10.70	10.48	9.95
45-54	11.70	11.77	11.30	10.91
55-64	9.94	11.08	9.34	10.17
65-74	9.54	9.49	7.66	9.56
75+	4.92	6.09	5.05	6.08
	Eta^2.02	$Beta^2$.03	Eta^2.05	$Beta^2$.03
Race				
Black	9.04	10.26	8.11	9.67
Non-Black	10.55	10.40	9.72	9.51
	Eta^2.01	$Beta^2$.00	Eta^2.01	$Beta^2$.00

TABLE 2 Continued

Predictors	*Econometric Procedure*		*Sampling Procedure*	
	Unadjusted Wage (Dollars/hour)	*Adjusted Wage (Dollars/hour)*	*Unadjusted*[a] *Wage (Dollars/hour)*	*Adjusted Wage (Dollars/hour)*
Number in household				
One	10.76	10.81	8.47	9.63
Two	10.61	10.38	9.93	9.81
Three	10.30	10.51	9.80	9.60
Four	10.46	10.30	9.53	9.29
Five or more	9.79	10.11	9.19	9.11
	Eta^2.00	$Beta^2$.00	Eta^2.01	$Beta^2$.00
Other family income				
None	11.02	10.99	9.61	9.99
Less than 10,000	8.85	8.97	8.39	8.31
10,000-29,999	9.85	9.86	9.42	9.08
30,000 or more	10.29	10.51	10.02	9.77
	Eta^2.02	$Beta^2$.01	Eta^2.01	$Beta^2$.01
Probability of working				
Less than .4	7.90	11.53		
Less than .6	8.04	10.16		
Less than .75	8.96	10.57	INAP	INAP
Less than .85	9.07	10.29		
Less than .95	11.30	10.25		
.95 or more	13.41	10.34		
	Eta^2.11	$Beta^2$.00		
Adjusted R^2		.30		.33

NOTE: Eta^2 indicates the gross amount of variance accounted for by the predictor; $Beta^2$ indicates the net amount of variance, controlling for the effects of the other predictors in the equation.

a. Unadjusted for other predictors, but adjusted for selection bias by reweighting each case by the inverse of its probability of working.

less than $500, $500 to $1,000, $1,001 to $3,000, or more than $3,000?" An hourly wage equivalent was arrived at by assigning midpoints to the dollar brackets and by dividing the amount saved by the number of hours spent.

Nonmonetary benefits. Respondents rated most of the major activities in terms of benefit to others. The interview questions used the following format: "Are there other people who are better off because of your (work on this job/volunteer work/etc.)?" For each activity, the

TABLE 3
Productive Hourly Values of Activities

Activity	*Wages (Dollars)*	*Opportunity Costs (Dollars)*	*Market Price Approach (Dollars)*	*Value-Added Dollars (Dollars)*	*Benefit Approach (1-4)*
Paid work	10.4	NA	NA	NA	3.4
Child care	NA	9.6	3.4	NA	3.3
Housework	NA	9.4	3.4	NA	NA
Home maintenance	NA	9.7	11.0	17.2	NA
Formal volunteer work	NA	10.1	NA	21.1	3.5
Informal help	NA	9.7	3.4	NA	3.4

NOTE: NA = not available.

ratings were made on a 4-point scale (4 = *A great deal better off* through 1 = *Not better off*).

General comments. Because of the nature of the valuing methods and the nature of the world, not all activities could be sensibly evaluated as to their productivity by all methods, resulting in an incomplete table (Table 3). For example: By definition, wage rate is only available for paid work; opportunity cost, market price, and value-added approaches are only sensible for unpaid work; the market price approach could not be used for volunteer work because of insufficient detail about the nature of the volunteer work; or, the benefit questions did not seem sensible to the respondents for housework and home maintenance when we pretested them and thus these questions were deleted from the final survey instrument.

STATISTICAL ANALYSIS

One-way analysis of variance and Multiple Classification Analysis (MCA, a form of multiple regression with dummy variables; see Andrews, Morgan, Sonquist, and Klem 1973) were used to analyze the data. Analysis of variance and MCA produce Eta^2 values that represent the variance accounted by a predictor unadjusted for the effects of other predictors in the equation. MCA also produces $Beta^2$ values that represent the amount of variance accounted for by a predictor that is adjusted for the effects of other predictors.

Findings

First, the productivity of each activity assessed by the different methods is examined. These different productive values are then used to estimate the productivity resulting from each specific activity. Finally, the total productive output is estimated, and age and gender patterns are examined.

PRODUCTIVE VALUES OF ACTIVITIES

The different methods consistently suggest that average formal volunteer work and home maintenance are as productive among those who engage in such activities as average paid work is among those who work, despite the fact that the former are not remunerated in the regular economy (Table 3). By both the value-added and the market price methods, home maintenance obtains average hourly dollar equivalents that are as high as or even higher than the average wage rate for paid work. The substantial difference between estimates resulting from the value-added and the market price methods may be due to difficulties among respondents in estimating either the amount saved or the number of hours spent (and the corresponding response error); to the inclusion of somewhat different activities under the two methods; to the fact that the worker often produces more than what corresponds to the wages (i.e., producer surplus); or to the possibility that materials and fringe benefits may be included in the estimate of the gross saving that is used in the value-added approach. This issue is addressed in the discussion.

Similarly, formal volunteer work reaches an average hourly dollar estimate by the value-added approach that is considerably higher than the average wage rate for paid work. Some of the same cautions as for home maintenance apply here and will be taken up in the discussion. For formal volunteer work a benefit rating is also available. This rating indicates that, on average, volunteer work is judged to be as beneficial by those who perform volunteer work as is paid work by those who work.

To summarize, the various methods for valuing productivity suggest consistently that on average the unpaid activities of formal

volunteer work and of home maintenance are as productive or as valuable as paid work.

For child care and informal help, different methods produce less consistent results: Whereas the market price approach shows these activities as considerably less productive than average paid work, the benefit approach ranks both as comparable in productivity. For these two activities the benefit approach serves as a useful corrective to the other methods, which are essentially based on the current economic system, which, as has been argued, contains biases against occupations performed by women, minorities, and to some degree, the elderly.

For housework only a market price estimate is available. This estimate suggests that housework is less productive than average paid work. Again, domestic employment, which was used as the basis for the market price estimate, represents a set of activities primarily performed by women and most likely reflects some bias.

For completeness, the table includes opportunity costs for all activities. The opportunity costs are similar but slightly lower than the average wages. This observation suggests that the estimation was successful in fashioning wages for those persons who do not work for pay according to those who do. The slightly lower means reflect the effect of the differences between the working and nonworking populations and of the correction for selection bias. Whereas opportunity cost estimates cannot be used to establish the productivity of an activity because they are based on the characteristics of the persons who perform the activities rather than on the nature of the activity, they are better suited than actual wage rates for comparison with other estimates of the same activity. This is the case because they are based on the same subset of respondents upon which the other estimates are based, namely those who perform a particular unpaid activity.

Gender differences on the different estimates of productive value indicate that women have actual and estimated wages that are about one third lower than those of men, but they do not differ from men in the benefit and value-added estimates (Table 4). Age differences show essentially a systematic decrease in wages and value-added estimates (with a slight increase in wages among younger adults), but no systematic decrease in benefits.

To summarize, although the different evaluation methods undoubtedly have their idiosyncratic biases, they consistently suggest that

TABLE 4

Weighted Values of Productive Activities, by Age and Sex

	Actual Wage (Dollars/hour)	*Actual + Estimated Wage (Dollars/hour)*	*Value-Added for Home Maintenance (Dollars/hour)*	*Value-Added for Volunteer Work (Dollars/hour)*	*Work Benefit (1-4)*	*Child Care Benefit (1-4)*	*Volunteer Benefit (1-4)*	*Informal Help Benefit (1-4)*
Males								
25-34	10.93	10.85	18.58	27.90	3.32	3.17	3.66	3.26
35-44	12.52	12.40	17.69	20.48	3.38	3.35	3.59	3.58
45-54	13.72	13.56	20.36	22.01	3.44	3.52	3.32	3.20
55-64	11.76	11.51	14.66	22.11	3.42	2.27	3.54	3.46
65-74	11.17	10.36	10.89	19.77	3.36	3.31	3.60	3.50
75 and over	6.32	6.06	11.71	15.00	3.16	3.57	3.48	3.39
Total Males	11.98	11.37	17.02	22.97	3.37	3.24	3.55	3.38
Eta^2	.029	.087	.018	.014	.000	.061	.026	.045
Unweighted *N*	894	1358	1184	525	894	437	238	483
Females								
25-34	7.85	7.47	19.71	22.57	3.33	3.14	3.51	3.41
35-44	8.91	8.61	20.45	20.75	3.50	3.39	3.50	3.49
45-54	9.06	8.88	15.34	18.51	3.53	3.37	3.69	3.57
55-64	7.92	7.69	13.97	17.11	3.27	3.81	3.48	3.47
65-74	7.74	7.17	13.69	15.22	3.32	3.33	3.50	3.53
75 and over	3.30	3.50	11.17	12.34	3.49	3.84	3.45	3.45
Total Females	8.39	7.61	17.35	19.52	3.41	3.29	3.53	3.48
Eta^2	.014	.108	.017	.032	.009	.015	.000	.000
Unweighted *N*	972	2259	1656	919	972	766	383	792

(Continued)

TABLE 4 Continued

	Actual Wage (Dollars/hour)	*Actual + Estimated Wage (Dollars/hour)*	*Value-Added for Home Maintenance (Dollars/hour)*	*Value-Added for Volunteer Work (Dollars/hour)*	*Work Benefit (1-4)*	*Child Care Benefit (1-4)*	*Volunteer Benefit (1-4)*	*Informal Help Benefit (1-4)*
Total								
25-34	9.67	9.18	19.12	25.04	3.32	3.15	3.59	3.33
35-44	10.78	10.35	19.12	20.63	3.44	3.37	3.54	3.53
45-54	11.70	11.27	18.05	20.34	3.48	3.46	3.50	3.40
55-64	9.94	9.46	14.31	19.19	3.35	2.81	3.51	3.47
65-74	9.54	8.45	12.44	17.02	3.34	3.33	3.54	3.52
75 and over	4.92	4.55	11.44	13.39	3.32	3.68	3.47	3.42
Total	10.39	9.38	17.19	21.05	3.39	3.27	3.54	3.43
Eta^2	.019	.089	.015	.021	.003	.019	.000	.013
Unweighted *N*	1866	3617	2840	1444	1866	1203	621	1275

NOTE: Eta^2 indicates the gross amount of variance accounted for by the predictor.

volunteer work and home maintenance are at least as productive as paid work, despite the fact that they do not command a market wage in the regular economy. For child care and informal help, the different methods produce less consistent results: although the benefit approach ranks them as comparable in productivity to other productive activities, the market price approach ranks them considerably lower.

ESTIMATION OF PRODUCTIVE OUTPUT IN SPECIFIC ACTIVITIES

Having developed dollar values per hour of activity, dollar output for specific activities can be estimated by multiplying hours by productive values, and age and gender differences in productive output can be examined. The different forms of valuation just discussed have predictable implications for the estimation of the productive output in terms of dollars. First, higher hourly values produced by some methods yield higher dollar outputs than lower hourly values of other methods. For example, child care amounts to a higher average dollar amount if the estimated wages are used for valuation than if the market price of babysitters is used, because the former is higher than the latter. The average dollar amount produced in home maintenance, on the other hand, shows little variation with the approach used because all three approaches produced similar hourly dollar values. These and other results may be confirmed by examining Table 5.

Second, gender differences in hourly dollar values that are consistent with gender differences in number of hours spent will tend to produce accentuated gender differences in dollar amounts; those that are opposite will tend to blunt gender differences. For example, men report less than two times as many hours of paid work as do women (Herzog et al. 1989), but when wages are used they show a dollar amount which is 2 1/2 times higher than that of women (Table 5, column 1). Another example is child care. Women, who report almost twice as many hours of child care as men do (Herzog et al. 1989), are figured as contributing a dollar amount that is barely higher (column 2). Of course, valuation methods that show little gender difference (as for example, the value-added or the market price approach) do not alter the size of the gender differences in hours.

Third, age differences in valuation methods are either nonexistent —with no effect on age differences in dollar output—or they show a

TABLE 5

Annual Hours of Productive Activities Multiplied by Different Valuing Methods

	Paid Work	*Child Care*		*Housework*		*Home Maintenance*			*Volunteer Work*	
	Wages	*(Est.) Wages*	*Market Price*	*(Est.) Wages*	*Market Price*	*(Est.) Wages*	*Market Price*	*Value-Added*	*(Est.) Wages*	*Value-Added*
Males (N = 1,358)										
25-34	24177.4	7471.1	2367.2	4511.4	1494.6	1184.2	1180.2	1467.3	287.7	461.1
35-44	28623.0	9420.5	2601.4	4242.2	1196.1	1531.9	1324.4	1604.0	474.5	596.1
45-54	30465.0	4434.9	1092.6	4333.2	1131.7	1278.5	1036.0	1206.1	521.4	502.3
55-64	16922.1	919.5	285.5	3321.4	1102.9	1147.2	1135.1	1171.6	254.6	352.6
65-74	5061.7	259.3	87.2	3544.0	1202.7	1151.2	1183.6	906.2	278.2	411.8
75 and over	231.3	162.1	103.6	2870.8	1669.6	486.0	835.9	635.1	140.3	263.1
Total Males	21706.7	5333.9	1556.6	4058.3	1296.1	1226.9	1163.4	1306.7	352.5	466.2
Eta^2	.173	.142	.184	.013	.015	.044	.019	.054	.022	.007
Females (N = 2,259)										
25-34	9922.7	10300.5	5085.1	8563.4	4238.5	469.6	674.1	782.2	168.0	388.2
35-44	12595.9	9531.0	4120.8	9986.7	4265.7	676.1	846.1	1003.8	359.7	568.3
45-54	13096.1	3055.0	1474.3	10019.7	4082.4	739.3	881.4	847.4	332.7	446.7
55-64	5992.3	748.5	470.3	9129.3	4161.3	541.2	725.7	613.9	223.4	288.0
65-74	1428.0	418.0	241.0	8167.6	4007.0	432.8	655.8	492.8	250.7	359.5
75 and over	81.8	49.1	64.8	3385.2	3280.1	146.0	467.8	251.3	80.0	150.7
Total Females	8472.8	5623.9	2655.2	8761.6	4106.0	534.4	731.3	738.0	248.1	402.3
Eta^2	.150	.295	.371	.054	.006	.047	.018	.050	.026	.017

Total (N = 3,617)										
25-34	17153.3	8865.3	3706.5	6508.1	2846.7	832.0	930.8	1129.7	228.7	425.2
35-44	19959.7	9480.2	3422.7	7347.3	2855.3	1069.3	1065.9	1279.6	412.4	581.1
45-54	21986.6	3761.3	1278.9	7109.0	2572.0	1015.3	960.6	1031.0	429.3	475.2
55-64	11062.5	827.8	384.6	6435.1	2742.6	822.3	915.6	872.7	237.9	318.0
65-74	2888.7	354.2	179.2	6309.0	2879.7	721.6	867.9	659.0	261.8	380.5
75 and over	143.1	95.5	80.7	3174.3	2619.6	285.4	618.8	408.7	104.8	196.8
Total	14705.3	5487.3	2137.8	6522.8	2782.7	860.6	934.8	1005.8	297.3	432.4
Eta^2	.144	.206	.263	.023	.000	.039	.015	.052	.022	.013

NOTE: Eta^2 indicates the gross amount of variance accounted for by the predictor.

similar pattern to the number of hours, thereby accentuating the age pattern (Table 5).

ESTIMATION OF TOTAL PRODUCTIVE OUTPUT

The final step involves an aggregation across activities to arrive at an assessment of total productive output. Through the use of the different valuation methods, several possible ways of aggregating can be explored. The first is a straightforward opportunity cost approach in which all hours of paid work are valued at the actual hourly wage; hours of unpaid work are also valued at the actual hourly wage or, if the respondent does not work, at the estimated hourly wage; and dollar values for each activity are then summed. Relevant figures by age and gender are shown in the first column of Table 6. These figures may be interpreted as average dollar amounts produced by paid and unpaid work, where unpaid work is valued in a similar way as paid work. The by-now characteristic age pattern can be recognized in these figures: a slight increase in productivity during early adulthood and a gradual and substantial decrease after the age of 45. A gender difference of about $10,000 in early and middle adulthood disappears almost completely by the age of 65, but the statistical interaction between age and gender explains less than 1% additional variance.

The second aggregation uses the value-added approach for home maintenance and volunteer work (the two activities for which this information was collected) and the estimated or actual wage for all other activities. The figures are shown in column 2 of Table 6. They are very similar to the figures in column 1, largely because home maintenance and volunteer work occupy relatively short amounts of time. The figures in column 2 are slightly higher because the value-added approach yielded higher dollar values than the estimated wage approach.

The third aggregation was the market price for housework and child care and actual or estimated wages for all other activities. This approach results in a decidedly lower dollar amount of total productivity because two of the most time-consuming activities — housework and child care — are valued at a much lower wage. This approach also blunts the age differences somewhat, but sharpens the gender differences in younger adulthood because of the relatively low hourly wages

TABLE 6
Three Estimates of Total Productivity in Annual Dollars, by Age and Sex

Sex and Age	N	*Opportunity Cost Only*	*Opportunity Cost + Value-Added Approaches*	*Opportunity Cost + Market Price Approaches*
Males				
25-34	332	37,938	38,395	29,810
35-44	228	44,811	45,005	34,945
45-54	166	41,240	41,148	34,642
55-64	250	22,781	22,904	19,927
65-74	231	11,106	10,991	8,521
75 and over	132	4,508	4,793	3,191
Females				
25-34	407	30,239	30,772	20,699
35-44	364	33,796	34,332	22,665
45-54	221	27,986	28,208	20,468
55-64	434	17,632	17,769	12,386
65-74	521	11,491	11,662	7,107
75 and over	297	4,104	4,285	4,012
Total	3,583	28,550	28,832	21,421
$Beta^2$ Sex		.027	.026	.066
$Beta^2$ Age		.232	.240	.223

NOTE: $Beta^2$ indicates the net amount of variance, controlling for the effects of the other predictors in the equation.

for child care and housework, activities that are predominantly performed by younger women. The statistical interaction between age and gender explains about 1.5% of additional variance.

Discussion

Within the social accounting tradition, this article addresses the productivity of men and women across the adult age range, using a greatly expanded definition of productivity. The definition is expanded in two ways. First, it broadens the definition of productive activities to include most forms of activities that produce valued goods or services, whether they are formally paid or not. Second, it improves upon previous assessments of such productive activities, in which only the number of hours spent in each activity had been used to measure

productivity. Because activities are not all productive in the sense of producing paid-for goods and services and because not all productive activities are equally productive, in this article productivity is deliberately assessed and the number of hours spent is multiplied by a value of hourly productivity.

Several methods proposed in the literature are used to establish the hourly value. What was learned about the relative quality of these methods? They result in different hourly values and in different age and gender patterns. For the activities that were explored, the value-added approach resulted in the highest hourly dollar value, the opportunity cost approach in the next highest. For housework and child care, the market price approach was decidedly lower than the other two approaches because these activities are paid little in the market; for home maintenance, the market price approach was closer to the other two approaches because craftsmen who perform home maintenance and related tasks in the market are paid close to the population's average wage.

Our opportunity cost estimation included a deliberate effort to model the selection bias inherent in using the working population as a basis for estimating opportunity costs of the nonworking population and to adjust the estimates accordingly. Interestingly, no selection bias remained when the specified sociodemographic predictors were used in the wage equation. Note, however, that this failure to find a selection bias effect does not necessarily mean that there is no bias problem; it may mean only that the selection process could not be modeled adequately. Nor does it eliminate the possibility that those who chose to do unpaid work are better at it.

The discrepancies in estimates of average dollar value by the three economic methods deserve some discussion. Perhaps the simplest explanation for the discrepancy between the value-added and the market wage/opportunity cost approach is that respondents exaggerate the value of their contributions when they estimate how much money they saved for themselves by doing their own home maintenance or for an organization by doing volunteer work. Or perhaps the number of volunteer and home maintenance hours is underreported (Hill 1985), which would also lead to an exaggerated hourly dollar value, despite the fact that the overall dollar savings might have been accurately estimated. Similarly, perhaps the number of annual hours

of paid work is overestimated (Duncan and Hill 1985), which might lead to an underestimate of hourly wages. Another possible explanation for the discrepancy is that the total estimated dollar savings required for the value-added approach includes materials that would have to be, but might not have been, subtracted before hourly wage paid for labor can be figured, and thus that the hourly dollar values for volunteer work and home maintenance estimated by the value-added approach are too high. However, such an explanation is more convincing for home maintenance, where materials are typically required, than for volunteer work; yet, it is volunteer work that yields the highest and most discrepant hourly dollar value. Similarly, the total amount saved may include fringe benefits, whereas the reported wages would not include them.

Perhaps the most plausible explanation is the difference between average and marginal product—the inclusion of producer surplus in respondent estimates of money saved in those activities. An activity may be performed with decreasing efficiency so that the last few hours are less productive than the earlier ones, and employers often set wage rates such that even the least productive hours result in an overall profit for the production process. But, in fact, the employee works for many hours at higher productivity, producing a "producer's surplus." As a consequence, if hours are valued by average actual or estimated wage rates, they probably result in an underestimate of the total productive output. With unpaid work, the heterogeneity of activity and the existence of highly productive intramarginal activities seems even more likely.

A marked discrepancy exists between valuations of child care, housework, and help to others produced by the opportunity cost approach on one hand and by the market price approach on the other. This discrepancy highlights the difference between these two approaches, a difference that largely rests on a theoretical basis. The theoretical decision that must be confronted is whether activities that command low market wages should be valued according to the activities being performed or according to the qualifications of the person who performs them. Because the market wage for these activities is very low relative to other activities, the resulting discrepancy is sizable for many women and is even greater for men.

A fourth nonmonetary valuation approach cannot be directly compared to the other three, because it is not measured in comparable units, dollars. It is also not clear whether this nonmonetary approach results in hourly or total values. The survey question used to measure nonmonetary value asked about how much others had benefited from the respondent's activity, and respondents who reported higher numbers of hours spent in the activity also tended to report higher benefits, which is consistent with the assumption that they reported aggregate rather than hourly benefits. Alternatively, it is possible that people spend more time in those activities they perceive as highly beneficial, and that this mechanism underlies the relationship. The available data do not permit us to differentiate between these two explanations. A further possible limitation of the benefit method is suggested by the skewness and the low variance in these ratings, which raises questions about their ability to differentiate.

What has been learned about the relative productivity of the different activities? The opportunity cost approach does not lend itself to establishing the productivity of a certain activity, because it estimates the wages foregone by not engaging in paid work without detailed consideration for the reason underlying the decision not to work for pay (the decision to spend time in leisure activities carries an opportunity cost, as does the decision to engage in housework or volunteer work). The market price and the value-added approaches are better suited for establishing productivity but, unfortunately, because of logical difficulties noted above, the ACL study does not contain a full set of estimates for all activities.

Nevertheless, it is easy to see from the partial sets that all of the activities examined here are productive to a certain degree. Volunteer work and home maintenance are productive at a level that is comparable to paid work. Child care and housework, on the other hand, are less productive when the market price approach is consulted. The nonmonetary approach that probes nonspecific benefits to other persons from the activity is a useful corrective for child care, because it shows unpaid child care to be only minimally less beneficial than paid work. As is well known, market wages reflect other aspects of an activity and its typical performer than productivity, and therefore they are only an imperfect proxy for productivity. This may also suggest that many women and some men engage in substantial amounts of

unpaid child care despite high opportunity costs precisely because they see the intangible benefits for the children, the family, and society at large.

It must also be noted that although it would be very useful to use these same methods to assess the productivity of some activities that do not qualify as productive under our definition (e.g., pure leisure activities), pretests found that survey questions designed to accomplish this were judged so awkward by the pretest respondents that they could not be used.

What are the implications of the assessment of productive value beyond the estimate of hours for the description of age and gender patterns? Depending on which approach for valuing hours is used, the overall pattern and the gender and age differences that had previously been observed for hours of productive activities (see Herzog et al. 1989) are somewhat modified. In previous estimates the total productive hours were highest for young adults, decreasing in older ages (i.e., 65 to 74) to somewhat more than one third of the hours spent by young adults. Women of all ages reported at least as many hours as men did. When an opportunity cost approach or a combination of value-added and opportunity approaches are used to value these productive hours, it seems that men contribute more productive output than women and that the age differences are somewhat more pronounced. The difference from simple hour estimates can be explained by the gender differences in actual and estimated wages that counteract the gender differences in numbers of hours and by the age differences in estimated and actual wages that compound the observed age pattern of numbers of hours. The combination of opportunity cost and market price approaches results in age and gender patterns that are even more markedly different from hour estimates than the other two approaches. Therefore, the conclusion reached previously with the hour assessment —that no gender difference in productivity exists—would have to be tempered in light of the measures and analyses presented here. Likewise, the conclusions of a modest age decrease would have to be modified to suggest a somewhat more substantial age decrease; those between 65 and 74 years of age contribute somewhat less than one third of those between 25 and 34, and even less compared to those between 35 and 54. Finally, the gender differences converge across age levels.

It should be recognized, however, that these estimates of productive value reflect the application of methods of economic estimation derived from a labor market system that many would argue has depressed wages in occupations and industries populated primarily by women and older people (and also by the youngest workers and minorities) and has normally placed no economic value on child care and housework within a person's own family and household. The one noneconomic approach that was proposed, although it cannot be translated into a dollar equivalent and therefore was not included for figuring total productive output, provides a useful corrective to the economic approaches and the status quo that they reflect. Because it shows little if any systematic age and gender differences, it would not substantially alter the patterns described for simple hours of productive activities. More generally, although exact quantification of productive output is difficult given the theoretical differences in the methods proposed to establish productivity, the general conclusion from the authors' previous work—that women contribute in major ways to U.S. productivity and that older adults also do so, although to a lesser degree—has been reaffirmed.

Moreover, the decreasing productive contribution of older adults is mostly a function of decreased work and child care hours (see Herzog et al. 1989, for details) and of the admittedly age-biased economic valuation methods presented in this article. What deserves emphasis is the finding that, unlike labor force indicators, the unpaid productive activities of formal volunteer work, informal helping, housework, and home maintenance show much less decrease by age. This finding documents that many older people are willing and able to stay involved in productive ways. Although their activities are not paid for in the market, they are useful and productive in the sense that if older persons were not performing them, corresponding products and services would have to be bought in the market and older persons could perform paid work instead. A telling example is the unpaid care of a dependent older relative: If the older caregiver were not providing the help, nursing or custodial care would have to be paid for and the caregiver could instead earn a salary by being employed. The finding of the atypically abrupt decrease in labor force participation about the age of early sixties suggests that retirement from paid work is at least as much a function of age-based societal norms and policies as inherent limita-

tions of any aging organism and that it does not generalize to other productive activities. Future research should focus on explaining why some older adults remain productively involved in these unpaid activities.

These results add to the recognition that many older people contribute to society by helping each other as well as by helping members of younger generations and by performing their own housework and maintaining their homes and other possessions. Such recognition could contribute to more comprehensive assessments of the societal roles of older citizens. It should also help to inform discussions on the relative burden placed on society by various age groups as in the intergenerational equity discussions.

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